

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Art Unit	:	1793	Customer No.:	035811
Examiner	:	Deborah Yee		
Serial No.	:	10/559,844		
Filed	:	December 7, 2005	Docket No.:	JFE-05-1735
Inventors	:	Nobuyuki Ishikawa Toyohisa Shinmiya Shigeru Endo Ryuji Muraoka		
Title	:	LOW YIELD RATIO, HIGH STRENGTH, HIGH TOUGHNESS, THICK STEEL PLATE AND WELDED STEEL PIPE, AND METHOD FOR MANUFACTURING THE SAME	Confirmation No.:	1864

Dated: January 23, 2009

RESPONSE

Mail Stop AF
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This is in response to the Official Action dated July 30, 2008.

Claims 25-34 stand rejected under 35 USC §103(a) as unpatentable over Tamehiro. The rejection states that Tamehiro discloses a hot rolled steel plate having a composition with constituents whose wt% ranges overlap those recited by the claims. The rejection further concedes that Tamehiro does not expressly teach the formation of complex carbide precipitates recited in the rejected claims, but alleges that they would be formed in Tamehiro's process because the steps are similar and the temperature ranges overlap.

The Applicants respectfully submit that the hot-rolled steel plate recited in the rejected claims is distinct from and non-obvious in view of the steel plate disclosed in Tamehiro because of the differences in the processes. In particular, the differences between the hot rolling finishing temperature of the claims and the temperature range taught by Tamehiro cause the microstructure of the resulting steel to be very different.

As shown in the attached Fig. 1 (left-hand side), the three-phase structure of ferrite, bainite, and island martensite recited in the claims is formed by hot rolling after heating at a temperature of 1000 to 1300°C and rolling finish temperature of Ar₃ or more, followed by accelerated cooling and reheating. (See paragraph [0060] of the Applicants' Specification.) Because the rolling temperature is Ar₃ or more, ferrite is not formed during rolling. Instead, the accelerated cooling is halted in the midst of bainite transformation where the microstructure consists of non-transformed austenite and bainite structure is formed. Only during reheating after accelerated cooling, non-transformed austenite turns into ferrite.

Additionally, during the reheating process, fine precipitates are formed and the C-concentrated portion in the austenite is further transformed to island martensite after air cooling. In a steel composition containing Mo and Ti or a combination of Mo, Ti, V, and Nb, a dispersed precipitate of an extremely fine complex carbide of Mo and Ti provides for even further improvement of ferrite strength. Alternatively, strength of the ferrite can be further achieved by forming a dispersed precipitate of a fine complex carbide containing two or more of Ti, V, or Nb. The precipitation of these fine precipitates during ferrite transformation increases the strength of the steel. Moreover, by the precipitation of the fine precipitates, since dissolved C or N casing strain aging is decreased, an increase in yield stress due to strain aging by pipe forming and coating heat can be suppressed. (See paragraph [0015] of the Applicants' Specification.)

In contrast, as seen in the attached Fig. 1 (right-hand side), Tamehiro teaches hot rolling under a condition in that the cumulative rolling reduction ratio is 10 to 70% in the ferrite/austenite two-phase zone of an Ar₃ point to an Ar₁ point and a hot rolling finish temperature of 650 to 800 °C prior to accelerated cooling. (See Tamehiro at col. 8, line 52 to col. 10, line 7.) Because Tamehiro uses a temperature of Ar₃ or less, ferrite is formed and then rolled into a flat shape.

The Applicants respectfully submit that the reason for Tamehiro's failure to expressly teach the formation of complex precipitates is because the process did not produce precipitates. Indeed, production of worked ferrite, as opposed to transformed ferrite with dispersed precipitate, is an important object of Tamehiro. For example, Tamehiro teaches that the intended strength and the low temperature toughness cannot be accomplished if the proportion of worked ferrite is too small. (See Tamehiro at col. 4, lines 53-65.) Furthermore, working, or rolling, the ferrite in Tamehiro's steel improves its yield strength by dislocation strengthening and sub-grain strengthening and is extremely effective for improving the Charpy transition temperature. Thus, Tamehiro's process is aimed at working the ferrite and further refining the austenite structure in the un-recrystallization zone.

Furthermore, the Tamehiro process is neither designed to nor capable of obtaining the three-phase microstructure and complex carbide precipitated in the ferrite phase, as recited in the Applicants' claims. Because Tamehiro teaches conducting accelerated cooling after rolling, the complex carbide precipitate that provides ferrite strengthening in the claimed steel cannot be precipitated. Therefore, the structure of the worked ferrite formed in the Tamehiro process is unlike the high strengthening of ferrite of the Applicants' claims because it is produced by being rolled and does not provide a dispersedly precipitated complex carbide.

Consequently, the Applicants respectfully submit that, even if the constituent composition of the rejected claims is similar to Tamehiro as the rejection alleges, the differences in treatment processes results in distinct microstructures and properties. For further explanation of the different changes in the steel microstructure caused by the steps and conditions of the Applicants' process and Tamehiro's process, the Applicants respectfully invite the Examiner to review Figure 1 and Table 1 attached herewith. Reconsideration and withdrawal are respectfully requested.

In light of the foregoing, the Applicants respectfully submit that the entire application is now in condition for allowance which is respectfully requested.

Respectfully submitted,



T. Daniel Christenbury
Reg. No. 31,750
Attorney for Applicants

TDC/vp
(215) 656-3381